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Contributions of Risk and Protective Factors to Prediction of Psychological Symptoms after Traumatic Experiences

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Abstract

Objective—Traumatic experiences cause considerable suffering and place a burden on society due to lost productivity, increases in suicidality, violence, criminal behavior, and psychological disorder. The impact of traumatic experiences is complicated because many factors affect individuals' responses. By employing several methodological improvements, we sought to identify risk factors that would account for a greater proportion of variance in later disorder than prior studies.

Method—In a sample of 129 traumatically injured hospital patients and family members of injured patients, we studied pre-trauma, time of trauma, and post-trauma psychosocial risk and protective factors hypothesized to influence responses to traumatic experiences and posttraumatic (PT) symptoms (including symptoms of PTSD, depression, negative thinking, and dissociation) two months after trauma.

Results—The risk factors were all significantly correlated with later PT symptoms, with post-trauma life stress, post-trauma social support, and acute stress symptoms showing the strongest relationships. A hierarchical regression, in which the risk factors were entered in 6 steps based on their occurrence in time, showed the risks accounted for 72% of the variance in later symptoms.

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Most of the variance in PT symptoms was shared among many risk factors, and pre-trauma and post-trauma risk factors accounted for the most variance.

Conclusions—Collectively, the risk factors accounted for more variance in later PT symptoms than in previous studies. These risk factors may identify individuals at risk for PT psychological disorders and targets for treatment.

Keywords

Post-Traumatic Stress Disorders; traumatic stress; risk; prediction; PTSD

The impact of traumatic stress is complicated because many factors affect individuals' responses. Our conceptual framework for the impact of traumatic experiences posits that responses to sudden, severe stressors are influenced by biological factors, childhood environment, past trauma, severity of the stressor, and life stress and social support during recovery [1, 2]. Factors that operate before trauma may directly or indirectly affect vulnerability to traumatic stress and risk for disorder, and later factors may exacerbate or ameliorate negative emotional responses to extreme stress. These risk factors operate in combination and at different times, and the relative contributions and interactions of factors vary across individuals.

Pre-Trauma Risk Factors

Among pre-trauma variables, demographic variables, particularly gender, race/ethnicity, education, and socioeconomic status, are frequently studied [3]. These are generally hypothesized to confer risk of disorder following traumatic stress, because they are associated with decreased availability of internal [1] and external [4] resources. While some meta-analytic studies have concluded that female gender is inconsistently associated with PTSD [5, 6], a review of epidemiological research concluded that female gender was associated with an increased risk of PTSD that could not be attributed to greater exposure to sexual assault, prior trauma, prior disorder, or reporting bias [7]. Possibly, gender is related to variables that confer risk but are not widely studied [8]. Higher education level, like greater cognitive capacity, has consistently been associated with lower risk for PTSD [5].

Other pre-trauma risk factors include adverse childhood environment, prior trauma, pre-trauma psychopathology, and pre-trauma life stress, which are also thought to confer risk by decreasing individuals' capacity to cope with traumatic stress [1]. Aspects of childhood environment, such as general adverse circumstances and maltreatment, have been associated with PTSD after trauma in adults [3, 5, 9]. Similarly, prior exposure to trauma has been associated with higher rates of PTSD and depression following exposure to a subsequent traumatic stressor [5, 6, 10], and frequency of prior trauma has been associated with severity of PTSD symptoms [11]. Preexisting psychopathology, emotional problems, and personality disorder have also been associated with PTSD and depression following trauma [5, 6, 9]. Life stress in the prior year predicted later depression in urban U.K. injured emergency service patients [12], whereas life stress in the prior two years was not associated with later depression, PTSD, or anxiety diagnoses in injured Swiss intensive care unit patients [13].

Time of Trauma Risk Factors

Of variables occurring at the time of trauma, trauma severity has been the most frequently studied in relationship to later PTSD symptoms. Using objective measures, several rigorous studies have found no significant relationship between injury severity and later PTSD symptoms [14, 15]. However, subjective indicators of trauma severity, such as perceived life threat, have been found to be significantly associated with later PTSD [6, 12]. Trauma type also appears to be associated with later symptoms [6, 16]. Dissociation occurring at the time of trauma, commonly referred to as peritraumatic dissociation, may reflect trauma severity, preexisting vulnerability, or both. Early studies of peritraumatic dissociation found it to be a moderate predictor of PTSD [6, 17], but a review of prospective studies concluded that peritraumatic dissociation did not independently predict later PTSD when early PTSD or dissociation symptoms were controlled for [18, 19].

Post-trauma Risk Factors

Post-trauma variables that have consistently related to later PTSD in prospective studies include acute psychiatric symptoms, social support, social constraints, and life stress. Traumatic stress exposure has been associated with symptoms of Acute Stress Disorder [20], PTSD [12, 14, 21], depression [12, 22], negative posttraumatic (PT) thinking [12, 23], and dissociation [24]. While these symptoms can be conceptualized as outcomes, they could also contribute to later disorder. Early responses of reexperiencing, avoidance, depression, negative thinking, and dissociation may lead to getting “stuck” in the process of recovery [25]. Reminders of trauma associated with overwhelming negative affect may evoke dissociative, cognitive, and behavioral avoidance. Depression symptoms such as hopelessness and negative thinking about oneself, others, and the world may impede behaviors that could foster recovery, such as seeking social support, exercise, and other positive coping behaviors.

Post-trauma social support has been found to account for a considerable amount of variance in long-term outcomes [5, 6, 26]. Social support is thought to be negatively associated with PTSD, because social connections contribute to well-being [27] and can foster cognitive and emotional processing of traumatic events [28]. Conversely, social constraints, which are messages that discourage disclosure or discussion of trauma, have been positively associated with PTSD [29]. Post-trauma life stress has been found to be associated with risk for PTSD [5, 30], presumably because such experiences deplete already compromised internal cognitive and emotional resources [1].

Methodological Challenges in Research on the Impact of Multiple Risk Factors

Research on the relative and collective contributions of risk and protective factors to prediction of disorder after trauma exposure has been limited by practical challenges inherent to recruiting and retaining research participants who were recently trauma-exposed [31]. In addition, the proportion of variance in outcomes that can be accounted for by risk factors is limited in many studies because they assess too few of the relevant risks, do not

measure risks or outcomes with enough precision, measure all risks retrospectively, and/or focus on PTSD symptoms as the sole outcome. Variance in risks and outcomes are also often constrained in studies, which results in smaller relationships between risk factors and outcomes. This applies to many convenience samples comprised of trauma-exposed or symptomatic individuals who respond to ads or seek treatment and samples of soldiers and first responders, who are typically screened to exclude those with poor mental health. Such selection for psychological health and resilience is an additional limitation of studies of soldiers and first responders, because it makes generalization of their results difficult. Studies of archival data and birth cohorts may not have constraint of variance, but because they were not designed to study the impact of risk factors, they typically assess too few of the relevant risks, the selection of variables is usually not theoretically driven, and they typically do not assess risk factors or outcomes in enough detail to accurately reflect the relationships between the various predictors and later disorder.

Design of the Current Study

The purpose of this study was to elucidate the contributions of a wide range of psychosocial variables to the etiology of PT symptoms. We sought to determine how much variance in responses psychosocial risk variables can collectively explain, the proportion of variance explained by variables occurring at different points in time, and the degree to which risk variables covary or explain unique variance in outcomes. The choice of vulnerability, protective, harmful, and ameliorative factors studied was guided by conceptual frameworks for the impact of traumatic stress [1, 2, 32, 33]. To capture the variance associated with risk factors, we used detailed measures for most risks and all outcomes. To reduce error in reports, time of trauma and early response variables were studied one to fourteen days after trauma exposure. To maximize the variance in risk factors and outcomes, we systematically recruited all potential participants in a trauma-exposed population with face-to-face interactions. The sample was diverse in trauma type and the range for response severity was broad. To best capture responses to traumatic experiences, we assessed symptoms of depression, PTSD, negative posttraumatic thinking, and dissociation. These symptoms are all highly associated with exposure to traumatic stress [12, 23, 24, 34] and all but depression are included in the DSM-5 diagnostic criteria for PTSD [35].

Method

Participants

The study was approved by a Stanford University Human Subjects in Medical Research review panel. Participants were 79 severely injured patients who were admitted to a level one trauma service at a university hospital and 68 spouses/partners or first degree relatives of severely injured patients. All participants reported distress about the event at the time of enrollment. Patients were recruited only when they were conscious and coherent (with a Glasgow Coma Scale score of 15). Exclusion criteria were having no memory of the trauma, being actively psychotic or suicidal, being assigned an alias by the hospital, expected discharge to jail, having no contact address after discharge, and continuing threat of death from injuries.

Measures

PTSD symptoms were assessed with the Screen for Posttraumatic Stress Symptoms (SPTSS) [36], a self-report measure of the 17 DSM-IV PTSD symptom criteria. The SPTSS has demonstrated good internal validity ($\alpha=0.91$) and good concurrent validity when correlated with other PTSD measures [36, 37]. Response options are 0 = “not at all”, 1 = “1 or 2 times”, 2 = “almost every day”, 3 = “about once every day”, 4 = “more than once every day”. Scores range from 0 to 68.

Depression symptoms were assessed with the short form of the Beck Depression Inventory (BDI). The BDI has demonstrated strong psychometric properties, including strong internal consistency, short-term test-retest reliability, and correlations with clinical ratings [38]. BDI-SF is a 13-item version of the full 21-item BDI, and scores of the two measures have correlated .9 and above in several studies of psychiatric patients [39]. Items are a series of 4 statements representing severity of symptoms in a particular domain. Respondents select the statement that best represents their experience, and item scores range from 0 to 3. For example, an item on sadness is: 0 = “I do not feel sad”; 1 = “I feel sad or blue”; 2 = “I am blue or sad all the time and I can’t snap out of it”; 3 = I am so sad or unhappy that I can’t stand it” Total BDI-SF scores range from 0 to 39.

Dissociative symptoms were assessed with the 20-item Dissociative Symptoms Scale (DSS) which has shown good internal validity (α s from .89 to .94) and strong correlations with other measures of dissociation ($r = .56-.66$) and PTSD ($r = .51-.55$) in community samples and samples of community outpatients and veterans with PTSD [40]. Response options are 0 = “not at all”, 1 = “1 or 2 times”, 2 = “almost every day”, 3 = “about once every day”, 4 = “more than once every day”. Total DSS scores range from 0 to 80.

Negative Thinking about oneself, others, and the world in relation to the traumatic event was assessed with items from the Post-Traumatic Cognitions Inventory (PTCI), which has shown good test-retest reliability and strong internal consistency ($\alpha = .97$) and correlations with symptoms of PTSD ($r = .79$), depression ($r = .75$), and anxiety ($r = .75$) [41]. A version of the Post-Traumatic Cognitions Inventory (M-PTCI) was used in this study that was modified to reverse half of the items to a positive direction and response options were 0 = “not at all”, 1 = “a little bit”, 2 = “some”, 3 = “a lot”. Total scores for the 18 negative PT cognitions range from 0 to 54. (Modified version of measure available upon request.)

Parental Dysfunction was assessed with 4 items asking whether any caretaker ever stayed in a hospital for emotional or psychiatric reasons, attempted or completed suicide, abused drugs or alcohol, or was arrested. Endorsement of items was summed to create a parental dysfunction score ranging from 0 to 4. In this sample, scores for this variable were significantly related to childhood home life scores ($r = -.52, p < .001$).

Childhood Home Life was assessed with a single global item about overall childhood home life: “How was your home life growing up?” Response options were 0 = “unhappy”, 1 = “mixed”, 2 = “OK”, 3 = “pleasant”, and 4 = “very happy”. As noted above, scores for this variable were significantly related to parental dysfunction scores ($r = -.52, p < .001$).

Past exposure to high magnitude stressors (HMS) and events associated with persisting PT distress were assessed with the Trauma History Screen, which has been found to be a reliable and valid measure of trauma exposure [34]. HMS scores are reports on the lifetime frequency of 14 types of potentially traumatic events. In results reported below, we use the term trauma events to refer to HMS events followed by significant distress that persisted for a month or more.

Pre-trauma Home Life was assessed with a single global item: “How is your home life now?” Response options were “unhappy”, “mixed”, “OK”, “pleasant”, and “very happy”. In this sample, scores for this variable were significantly related to scores for pre-trauma life stress ($r = -.47, p < .001$).

Pre-trauma and Post-Trauma Life Stress was assessed with the Perceived Stress Scale (PSS) [42], a 10-item scale that assesses subjective perceptions about life stress in the past month. The PSS shows good short-term test-retest reliability ($r = .85$) and validity in relating to burnout measures and predicting behaviors and psychiatric outcomes [42]. Response options for the PSS are 1 = “never”, 2 = “almost never”, 3 = “sometimes”, and 4 = “fairly often”. Total scores range from 0 to 40.

Psychopathology at the time of the event was assessed with the Millon Clinical Multiaxial Inventory-III (MCMI-III), a comprehensive, 175-item inventory that provides scores on 10 clinical syndrome and 14 personality scales corresponding to DSM-IV Axis I and Axis II disorders [43]. Individual scales of the MCMI-III show good to excellent reliability and adequate to good sensitivity and specificity [43]. Participants were asked to complete the MCMI-III to reflect their behavior and feelings before the injury. MCMI scale scores cannot be summed to index psychopathology as some items load onto multiple scales. To reduce the number of scores for statistical analyses, the 24 scales were subjected to factor analysis, consistent with the DSM-5 single axis model. Principal components analysis yielded two factors that accounted for 73% of the variance in scores, and their sum was used as an index of psychopathology in analyses.

Subjective Trauma Severity was assessed based on a theoretical framework for the mechanisms of traumatization, which proposes that trauma severity is subjective and related to suddenness, uncontrollability, and negative valence [1, 2]. Scores were summed ratings of how “terrible” and “out of control” an event seemed with response options of 0 = “not at all”, 1 = “a little”, 2 = “some”, 3 = “much”, and 4 = “very much”. Scores were significantly related to acute stress symptom scores ($r = .34, p < .001$).

Post-trauma Social Support was assessed with items from the Medical Outcomes Study Social Support Survey (SSS), a well-established, 19-item, self-report measure of emotional, tangible, informational, affectionate, and positive social interaction over the past month [44]. Good temporal stability over one year ($r = .71$), and very high Cronbach’s alpha (.97) and construct validity have been reported [44]. Response options were 0 = “none of the time”, 1 = “a little of the time”, 2 = “some of the time”, 3 = “most of the time”, and 4 = “all of the time”. Total scores on the SSS range from 0 to 76.

Post-trauma Social Constraints were assessed with the 15-item Social Constraints Scale (SCS), which assesses perceptions of social constraints on expressing trauma-related thoughts and feelings [45]. Cronbach's alphas for the SCS range from .89 to .93 in trauma survivors, reflecting very good construct validity [46]. In this study, participants were asked to report their perceptions over the past week. Response options were 0 = “never”, 1 = “rarely”, 2 = “sometimes”, and 3 = “often”. Total scores on the SCS range from 0 to 45.

Procedure

Admitted patients were identified via hospital electronic records and approached in their hospital rooms between one and fourteen days after injury. Family members were approached in the patient's room or in waiting areas. After informed consent was obtained, participants completed all measures except the Social Support Survey and Social Constraints Scale. Two months post-trauma, participants completed the Perceived Stress Scale, Social Support Survey, Screen for Posttraumatic Stress Symptoms, Beck Depression Inventory – Short Form, Modified Posttraumatic Cognitions Inventory, and the Dissociative Symptoms Scale.

Preliminary Data Analyses

Data were examined for outliers and scores for trauma exposure variables (HMS and PPD events) were transformed using Winsorization, with outlier scores beyond the 95th percentile replaced with the score falling at the 95th percentile. Social support and social constraints were combined into one index of social support, consisting of the standardized SCS score subtracted from the standardized SSS score. Scores for symptoms of acute stress (PTSD and dissociation at baseline) were highly correlated ($r = .72$), indicating that the symptoms may reflect single acute stress symptoms factor. When subjected to principal components analysis, a single acute stress symptoms factor emerged that accounted for 86% of variance in scores. Therefore, the early response risk factor was represented by acute stress symptoms factor scores from this analysis. Similarly, scores at two months post-trauma for symptoms of PTSD, depression, negative thinking, and dissociation were highly correlated ($r = .69$ to $r = .83$), and principal components analysis of these four symptoms identified one PT symptoms factor that accounted for 82% of variance in scores. The primary outcome for analysis was therefore represented by the PT symptoms factor scores from this analysis.

Pre-trauma life stress was missing for 44.6% because it was added mid-way through the study, and 2.3% to 13% of data were missing for other variables. All missing data were considered Missing Completely At Random. Tolerance values indicated no problems with multicollinearity. Multiple imputation was conducted to address missing data. This approach uses available data for variables related to the missing data to impute missing values from a distribution of possible values. This process is done multiple times (in this case, 5) to generate multiple complete data sets with different imputed values. Data analyses are conducted separately on the imputed datasets and then pooled into a set of final results.

Results

Of 230 patients and family members who were eligible for the study and invited to participate, 19 (8.3%) declined and 211 (91.7%) agreed to participate. Of those enrolled, 147 (70%) completed baseline measures. Follow-up measures were obtained for 132 (90%) of those who had completed the baseline. Analyses on all variables collected at baseline comparing completers to those lost to follow-up showed that retention was higher for females (85.4% vs. 72.9%; $\chi^2 = 3.86$, $p < .05$) and participants retained had significantly more years of education (15.0 vs. 13.9; $t = 2.3$, $p = .023$). Information on the recent trauma type and demographics for the 147 participants are presented in Table 1. Socioeconomic status was determined using the Hollingshead 2-factor Index [47]. Of note, a substantial proportion of participants reported exposure to physical or sexual assault as a child (25%) or as an adult (23%). Exposure to such interpersonal violence at some time in the past was reported by 36% of participants. These experiences were represented in counts of past HMS and past trauma events.

T-tests and Chi-Square analyses comparing injured patients to family members on all risk factors studied revealed no significant differences between patients and family members in levels of any risk factor or any outcome measured at any time point. T-tests comparing PT symptoms factor scores across participant type (patient vs. family member), gender, ethnic minority/majority, and married/not married showed no significant differences. PT symptoms factor scores were not significantly related to age or socioeconomic status. Table 2 shows means, standard deviations, and ranges for all observed risk factors and outcomes. Table 3 shows correlations among the risk factors and two-month PT symptom variables in the original (non-imputed) data.

Imputation and regression analyses were conducted on data from 129 participants. Three participants' data were not included because scores for one or more of the four outcomes assessed were missing. Table 4 shows results of a hierarchical regression conducted on the imputed datasets. Predictors were entered in sets that reflect their chronological occurrence. We entered early life factors in a separate step from more recent pre-trauma factors and trauma severity in a separate step from acute stress symptoms in order to examine these variables' independent levels of association with PT symptoms. The full model including six sets of variables yielded $R^2 = .72$ ($p < .001$). An identical hierarchical regression predicting DSM-IV PTSD scores (assessed by the SPTSS) revealed similar contributions of predictors and an R^2 value of .66.

Discussion

The psychosocial risk and protective factors we studied were related in the expected directions to each other and later PT symptoms. Collectively, they explained 72% of variance in later symptoms of PTSD, depression, negative cognitions, and dissociation and 66% of the variance in later DSM-IV PTSD symptoms. The total variance accounted for with this set of risk factors is higher than for previous studies, which were found to account for 40 to 60% of the variance in PTSD symptoms in studies assessing the outcome with a self-report measure [48–51] and 32 to 39% of the variance in studies assessing the outcome

with an interview [52–55]. In our analysis, individual risk factors accounted for as much as 10% of unique variance in later symptoms at steps of the analysis (representing particular points in time), and there was considerable shared variance among risks at every step. In the final model, 54% of the variance associated with risks was shared. Notably, most of the variance in PT symptoms was accounted for by pre-trauma and post-trauma risk factors.

The model including only early childhood factors of parental dysfunction and childhood home life accounted for 16% of variance in later PT symptoms and 12% of the variance in DSM-IV PTSD symptoms. These findings are consistent with prior research findings which indicate that early adversity can have long-term negative effects [56]. Theories about the role of a secure attachment in the development of mentalization capacities can explain how early adversity may exacerbate or create vulnerability to later traumatic stress and how secure attachment to emotionally supportive caregivers during early childhood may strengthen coping or create resilience to traumatic stress [57]. Interaction with a consistent, emotionally responsive caregiver during infancy is a critical element of social, emotional, and cognitive development, and lack of such interactions can lead to impairments in the ability to calm oneself when emotionally threatened, think about others' and one's own emotional states, or create and maintain relationships that can provide emotional comfort when it is needed [57, 58]. Research on the interaction of early environment with genetic vulnerability has found that childhood adversity can amplify genetic vulnerabilities while an emotionally responsive environment can be protective for those with genetic vulnerabilities [59].

Step 2 of the regression appears to show that past severe stressors, past trauma events, and the age of the first trauma are collectively associated with significant variance in response to the recent injury event. This finding is consistent with research showing that higher levels of prior trauma are associated with more severe responses to subsequent trauma [5, 6, 11] and research showing an association between earlier age of trauma and PTSD symptoms [60]. It is worth noting that the frequency of past severe stressors, past trauma events, and the age of first trauma were associated with more variance in the response to the recent injury than the severity of the recent injury event, which was entered at Step 4. Years of education also contributed significant variance at this step. More education may have served as a protective factor, consistent with conservation of resources theory [4]. In addition, vulnerabilities associated with early childhood adversity may have had a negative influence on access to or success in higher education, which is consistent with the significant association observed between age of first trauma and years of education.

Pre-trauma psychopathology accounted for a significant amount of unique variance in later PT symptoms in 3 of the 4 steps in which it was included. This variable seems likely to reflect both innate and acquired vulnerability to disorder, which is consistent with its relationship to all other risk factors. However, it is important to note that most of the measures of environmental variables such as past trauma, childhood and pre-trauma home life, and life stress were subjectively defined variables, and it is likely that underlying psychopathology influenced these subjective experiences and reports.

It is also worth noting that some variables that are sometimes associated with symptoms after trauma were not related to outcomes in our sample. Findings of no differences across

minority groups or marital status may be due to low power for those analyses, but the analysis finding no difference in PTSD across gender had adequate power and is consistent with finding of no gender differences in a large, prospective study of PTSD after military service in veterans [61].

Risk factors with the strongest relationships to PT symptoms were post-trauma life stress, post-trauma social support (including social constraints), and acute stress symptoms. The relationships of these factors to later PT symptoms are consistent with findings of prior research [5, 6, 26, 52, 62], but the finding that each accounted for unique variance in outcomes cannot easily be compared to findings from prior research as we know of no studies that included all of the risk factors we studied. Prior studies of life stress as a risk factor for PTSD also found it to be the strongest of many predictors with a weighted r of .36 in studies of civilians [5]. Similarly, social support has been very strongly related to PTSD in studies of civilians and veterans [5]. The strong relationship of social support and constraints to PT symptoms is consistent with adult attachment theory which posits that adults look to loved ones for help coping with strong emotions [63].

While the majority of variance in PT symptoms is shared among variables at each step, the shift in unique variance across time may indicate that factors that occur later in time (or more proximal to the time the outcome was assessed) have greater influences on outcomes. This pattern of unique variance appearing to “travel” across time is consistent with a similar study of risk and protective factors in former child soldiers in Sierra Leone [64]. Aspects of war experiences such as killing or injuring others were initially significantly related to later disorder and adaptive behaviors, but that relationship was no longer significant once the effect of later protective factors such as social support was added to the model. Ehlers found a similar pattern with unique variance “traveling” in time from earlier predictors to later predictors in a sample of patients injured in motor vehicle accidents [48]. Our interpretation of this pattern in our study and others is that the influence of risk factors tends to be time-limited. Risk factors that are farther “downstream” have more influence on outcomes than earlier risk factors, because the earlier factors represent only the potential for vulnerability, not its actual impact.

Strengths and Limitations

Strengths—This study has a number of strengths in design and methodology. Perhaps most importantly, it was specifically designed to investigate variance in outcomes associated with risk and protective factors. Theory guided selection of risk factors and outcomes, and a wide range of possible etiological factors were assessed that are hypothesized to operate at different times in relation to trauma exposure. In addition, including factors that are thought to decrease risk as well as increase it may have contributed to the high amount of variance accounted for, because these factors may operate, in part, through different mechanisms. Other strengths included systematically recruiting trauma-exposed patients and family members and studying a socioeconomically diverse sample which showed a relatively large amount of variance in most risks. We were also able to collect data for some variables prospectively, and the participant retention rate of 80% contributes to the overall validity and generalizability of results. Because we used dimensional, rather than categorical measures,

we were able to apply statistical methods that allow quantification of effects. Lastly, we assessed multiple, dimensional outcomes related to traumatic stress, rather than diagnosis.

Limitations—There were a number of limitations to the study related to the sample studied, measurement methods, and the variables studied. Although the study sample was socioeconomically diverse, higher SES classes were overrepresented, most likely due to the patient population that was sampled. Similarly, although the study sample was diverse in their exposure to a wide variety of past traumas, it was limited in focus on recent traumas of traumatic injury and traumatic injury of a loved one. The contributions of various risk factors may differ for responses to other types of traumatic stressors. A limitation related to measurement methods was that post-trauma life stress, social support, and social constraints were assessed at the same time point as the outcomes. Another measurement methods limitation is that we obtained risk factor and outcome data from the same reporter by the same measurement method. While this is common, it can bias results of behavioral studies [65] and may have inflated the amount of variance in the outcomes associated with the predictors compared to other studies that assessed outcomes using structured interviews.

Another limitation was that some variables thought to influence responses to traumatic experiences were not measured in detail, such as early home life and parental dysfunction. Similarly, other theoretically important variables were not included in the study, such as biological vulnerability (or resilience). Innate or acquired biological factors are thought to affect responses to traumatic stress [66, 67], but no variables have yet been identified that are reliably associated with the development of disorder after traumatic stress or that can accurately predict PTSD [66, 68]. Recent reviews conclude that genetic vulnerability to PTSD appears to be conferred by very many, weak gene effects that overlap with genetics of mood disorders and will require very large sample sizes to detect [69, 70].

Conclusions

In conclusion, many psychosocial variables account for variance in PT symptoms. These contributions appear to change over time, and much of the variance in the outcome is shared among many variables. Given the large amount of variance in outcomes accounted for, the risk factors we studied may have the capacity to accurately identify individuals who are at risk for PT symptoms. In addition, the risk factors studied may point to targets for intervention. In particular, post-trauma risks, such as life stress, social support, and social constraints, appear to account for considerable variance in outcomes and could be addressed in recent trauma survivors.

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Table 1**Trauma Type and Demographics**

Recent Trauma Type	
Learning/witnessing injury of family member	46%
Motor vehicle accidents	36%
Accidental injury at home or work	15%
Interpersonal violence	3%
Gender	
Male	42%
Female	58%
Age	
Mean = 44 (<i>SD</i> = 14.1); Range 16 to 85	
Marital Status	
Married or living with partner	56%
Separated, divorced, or widowed	24%
Never married	20%
Ethnicity	
Caucasian	69%
Hispanic/Latino	15%
Asian or Pacific Islander	8%
Mixed race or other	7%
African American	4%
Socioeconomic Status	
Lower or Lower Middle Class	7.1%
Middle Class	39.3%
Upper or Upper Middle Class	53.6%

Table 2

Descriptive Statistics for Risk Factors and Outcomes Assessed

	Mean	SD	Range
Parental Dysfunction	0.73	0.99	0 – 4
Childhood Home Life	2.27	1.30	0 – 4
Age at First Trauma	23.8	16.28	1 – 79
Past High Magnitude Stressors	7.2	7.90	0 – 30
Past Trauma Events	2.02	2.26	0 – 8
Years of Education	15.0	2.58	8 – 21
Pre-trauma Life Stress	14.6	8.21	2 – 34
Pre-trauma Home Life	2.79	1.26	0 – 4
Subjective Trauma Severity			
Out of Control during trauma	2.47	0.86	0 – 3
Terribleness during trauma	2.43	0.89	0 – 3
Acute Stress Symptoms			
PTSD Symptoms at baseline	12.0	11.03	0 – 60
Dissociation Symptoms at baseline	10.7	10.64	0 – 62
Post-trauma Life Stress	18.1	7.99	0 – 35
Post-trauma Social Support	66.7	18.93	21 – 95
Post-trauma Social Constraints	24.8	9.55	15 – 60
Posttraumatic Psychological Symptoms			
PTSD Symptoms at 2 months	13.2	11.89	0 – 54
Depression Symptoms at 2 months	6.7	6.50	0 – 28
Negative Thinking at 2 months	12.0	9.85	0 – 45
Dissociation Symptoms at 2 months	7.8	9.99	0 – 63

Table 3

Pearson Correlations Involving Predictor Variables and Two Month Post Injury Posttraumatic Symptoms

	Parent Dysfunction	Childhood Home Life	Age at First Trauma	Past High Magnitude Stressors	Past Trauma Events	Years of Education	Pre-trauma Home Life	Pre-trauma Psychopathology	Pre-trauma Life Stress	Subjective trauma severity	Acute Stress Symptoms	Post-trauma Life Stress	Post-trauma Social Support
1. Parent Dysfunction	–												
2. Childhood Home Life	-.52***	–											
3. Age at First Trauma	-.21*	.39***	–										
4. Past High Magnitude Stressors	.19*	-.40***	-.46***	–									
5. Past Trauma Events	.24**	-.43***	-.48***	.66***	–								
6. Years of Education	-.06	.14	.24**	-.18*	-.12	–							
7. Pre-trauma Home Life	-.23*	.43***	.16	-.22*	-.26	.16	–						
8. Pre-trauma Psychopathology	.28**	-.35***	-.31***	.34***	.34***	-.29**	-.43***	–					
9. Pre-trauma Life Stress	.29**	-.37***	-.36***	.21*	.34***	-.28**	-.47***	.45***	–				
10. Subjective Trauma Severity	.25**	-.16	-.15	.09	.25**	.03	.01	.19*	.25**	–			
11. Acute Stress Symptoms	.34***	-.36***	-.33***	.19*	.26**	-.28**	-.28**	.61***	.43***	.34***	–		
12. Post-trauma Life Stress	.43***	-.50***	-.58***	.26*	.30**	-.34**	-.41***	.62***	.61***	.19	.57***	–	
13. Post-trauma Social Support	-.30***	.38***	.31***	-.25**	-.29***	.16	.37***	-.45***	-.46***	-.12	-.52***	-.62***	–
14. Posttraumatic Symptoms	.32***	-.37***	-.37***	.33***	.40***	-.26**	-.32***	.59***	.50***	.31***	.66***	.72***	-.71***

Note. Correlations conducted on original (non-imputed) data.

* $p < .05$.** $p < .01$.*** $p < .001$.

Table 4
 Hierarchical Multiple Regression Predicting Posttraumatic Symptoms Two Months after Traumatic Injury

Risk Factor	Step 1		Step 2		Step 3		Step 4		Step 5		Step 6	
	β		β		β		β		β		β	
Parental Dysfunction	.17		.17		.10		.07		.04		-.04	
Childhood Home Life	-.28**	(6%)	-.11		-.04		-.04		-.003		.04	
Age at First Trauma			-.13		-.04		-.04		-.007		.12	
Past High Mag Stressors			.03		.02		.04		.07		.05	
Past Trauma Events			.21*	(2%)	.15		.12		.13		.14	
Years of Education			-.17*	(3%)	-.06		-.07		-.04		-.03	
Pre-trauma Home Life					.04		.01		-.02		.008	
Pre-trauma Psychopathology					.39***	(10%)	.37***	(9%)	.19*	(2%)	.06	
Pre-trauma Life Stress					.22*	(2%)	.19*	(2%)	.16		.02	
Subjective Trauma Severity							.13				.07	
Acute Stress Symptoms									.36***	(7%)	.24*	(2%)
Post-trauma Life Stress											.34***	(4%)
Post-trauma Social Support											-.38***	(7%)
R^2	—		.12***		.18***		.02***		.07***		.17***	
Total R^2	.16***		.28***		.46***		.48***		.54***		.72***	

Note. Results were pooled from five imputed datasets; Variables entered at each step are marked in gray; R^2 = change in R^2 at each step; β = standardized (beta) regression coefficients; In parentheses for significant β values is the squared part correlation or percent of unique variance in PT symptoms accounted for by the risk factor.

* $p < .05$.

** $p < .01$.

*** $p < .001$.